STATE OF ARIZONA● EMERGENCY MEDICAL SERVICES AND TRAUMA SYSTEM

Training Curriculum
For
Automatic Transport Ventilator (ATV) – Inter-facility Transport

Course Description
This course is designed to provide instruction for the use of an Automatic Transport Ventilator (ATV) by a certified EMT-Intermediate '99 or Paramedic as approved by an administrative medical director.

Prerequisites
1. The EMT must be a certified EMT-Intermediate '99 or Paramedic**,** with the approval of the administrative medical director.

Methodology
This guidance document suggests the following didactic, psychomotor, written and practical evaluation, and remediation process to ensure proficiency.

The following is a breakdown of the following recommended minimum hours for training:

- 1 hour – Didactic/lecture
- 1 hour – Psychomotor/hand-on practice
- ½ hour – Written and skills evaluation
- ½ hour – Remediation

Instructor/Faculty
The instructor must be approved by the administrative medical director and meet the following requirements:
1. Would qualify, under A.A.C. R9-25-312(D), to serve as a preceptor for a course at the level of EMT certification held by the EMT; and
2. Is authorized to perform the supplemental skill**.**

Equipment
The following minimum equipment should be available for the course:
1. Body Substance Isolation equipment
2. Automatic Transport Ventilator (ATV)
3. Airway manikin
4. Airway adjuncts
5. Oxygen supply
6. Bag-Valve-Mask
7. Suction device

Note: *Content material may vary slightly depending on the type of Automatic Transport Ventilator (ATV) being used. The instructor will need to make necessary adjustments based on the type of equipment.*

Course Competencies:

1. Discuss the common pathological events that affect the pulmonary system.
2. List the indications, contraindications, advantages, and disadvantages of an Automatic Transport Ventilator (ATV).
3. List and describe the features of the Automatic Transport Ventilator (ATV).
4. Discuss the respiratory volumes and capacities.
5. Describe and demonstrate the proper use of Body Substance Isolation (BSI).
6. Describe and demonstrate the assembly and application technique of the Automatic Transport Ventilator (ATV), rate, and high pressure alarm settings.
7. Discuss and demonstrate the tidal volume settings, by ml/kg for the Automatic Transport Ventilator (ATV).
8. Discuss and demonstrate assessment of the patient to determine efficacy of the Automatic Transport Ventilator (ATV).
9. Demonstrate how to decontaminate and reassemble the Automatic Transport Ventilator (ATV).
10. Discuss the maintenance and quality control of the Automatic Transport Ventilator (ATV).
11. Discuss the role of the administrative medical direction and oversight in the use of the Automatic Transport Ventilator (ATV).
12. Complete a written and practical skills evaluation with 80% competency; no failure of critical criteria.
13. (Optional) Discuss the epidemiology, anatomy, physiology, pathophysiology, assessment findings, and management for the following respiratory diseases and conditions:
    a. Adult respiratory distress syndrome (ARDS)
    b. Bronchial asthma
    c. Chronic bronchitis
    d. Emphysema
    e. Pneumonia
    f. Pulmonary edema
    g. Pulmonary thromboembolism
    h. Neoplasms of the lung
    i. Upper respiratory infections
    j. Spontaneous pneumothorax
    k. Hyperventilation syndrome

COURSE OUTLINE
Module 1: Lecture

Introduction:
The Automatic Transport Ventilator is essentially a flow-restricted, oxygen-powered ventilation device (FROPVD) attached to a control box that allows the variables of ventilations to be set. They have been shown to be excellent at providing and maintaining a constant rate and tidal volume during ventilation and maintaining adequate oxygenation of arterial blood. In addition, most ATVs use oxygen as their power source, thereby providing 100% oxygen during ventilation.

I. Indications

A. Extended ventilation of intubated patients or alternative airway
B. In situations in which a BVM is used
C. Can be used during CPR
D. Inter-facility transport with intubated patients
E. To control rate and tidal volume of ventilation in order to prevent complications of hyperventilation.

II. Contraindications

A. Absolute
   1. Children less than 5 years of age
   2. Obstructed airway
   3. Pneumothorax (after needle decompression)
B. Relative
   1. Awake patients
   2. Increased airway resistance or poor lung compliance
   3. Asthma
   4. Pulmonary edema

III. Advantages

A. To control rate and tidal volume of ventilation in order to prevent complications of hyperventilation.
B. Oxygen can be delivered at lower inspiratory flow rates and for longer inspiratory times, thereby lessening the likelihood of gastric distention
C. Frees your hands to perform other tasks, such as maintaining a mask seal or ensuring patency of the airway
D. The device can be set to deliver tidal volume, respiratory rate, and minute volume
E. Some device have alarms to indicate high airway resistance**,** low pressure in the oxygen tank as well as accidental disconnection from the ventilator
F. Lightweight, portable, and durable
G. Mechanically simple
H. Adapts to portable oxygen tanks

IV. Disadvantages

A. Because most ATVs are oxygen powered, constant oxygen supply is needed to power the device. Bag-valve-mask device should always be readily available when using the Automatic Transport Ventilator (ATV)
B. The Automatic Transport Ventilator (ATV) cannot be used in children less than 5 years of age
C. When using the Automatic Transport Ventilator, it is not possible to feel an increase in airway resistance or decrease in lung compliance
D. Cannot detect tube displacement
E. Difficult to secure

V. Features

***Note**: Content material may vary slightly depending on the type of Automatic Transport Ventilator (ATV) being used. The instructor will need to make necessary adjustments based on the type of equipment. The content of this section will be specific to the device being used. It is important that all components are discussed.*

The minimum desirable features of the ATV are as follows:

A. Time or volume cycled device
B. A standard 15/22 mm adapter to fit a tracheal tube, mask, or other airway adjunct
C. A rugged design that is also lightweight (2-5 kg)
D. Capable of operating under temperature extremes and under all environmental conditions
E. A peak-inspiratory-pressure-limiting valve that is set at 60 cmH_2O but can be increased to 80 cmH_2O or lowered to 20 cmH_2O
F. An audible alarm that indicates high airway pressure or poor lung compliance when peak inspiratory limiting pressure is generated
G. Minimal gas consumption so that the device can operate for a minimum of 45 minutes on an E cylinder
H. Ability to deliver 100% oxygen with each ventilation
I. Ability to deliver each ventilation over a 2-second period at a maximum flow rate of approximately 30L/minute in the adult and 1 second duration in children with a maximum flow rate of 15 L/minute
J. If it has a demand-valve feature, it should deliver an inspiratory flow rate of at least 100 L/minute and triggered at -2 cmH_2O inspiratory pressure to reduce the work of breathing
K. Will deliver a ventilation rate of 10 ventilations per minute in the adult and 20 ventilations per minute in the child with the ability to adjust the rate

VI: Respiratory volumes and capacities

***Note**: Content material may vary slightly depending on the type of Automatic Transport Ventilator (ATV) being used. The instructor will need to make necessary adjustments based on the type of equipment.*

A. In most cases respiratory rate is set at the midpoint or average for the patient's age.
B. Tidal volume is usually estimated using the formula of 4 to 6 mL/kg because ATVs are oxygen powered and provide oxygen enriched breathing gas.

C. The tidal volume can be adjusted based on the patient's chest rise and physiologic response.

VII: Proper Body Substance Isolation (BSI)

To reduce the risk of exposure, important pieces of protective gear include the following:

A. Gloves
B. Mask
C. Eyewear
D. Gowns or aprons (if indicated)

VIII: Assembly, application technique, efficacy of the Automatic Transport Ventilator (ATV), and troubleshooting

***Note**: Content material may vary slightly depending on the type of Automatic Transport Ventilator (ATV) being used. The instructor will need to make necessary adjustments based on the type of equipment.*

A. Appropriate Body Substance Isolation (BSI) must be used when performing this procedure
B. Assembly of the Automatic Transport Ventilator
   1. Hand tight all fittings.
   2. Attach regulator to oxygen cylinder, check for adequate pressure (>1000 psi)
   3. Attach the oxygen line to the high pressure outlet on the regulator (quick-release oxygen line connector device is highly recommended).
   4. Connect patient valve supply tubing.
C. Application

***Note**: Use of the Automatic Transport Ventilators (ATV) should not impede the management of the patient's airway. Opening the airway with basic maneuver and providing proper ventilation is the first priority in performing the vital basic skills in perfusion.*

1. Determine the indication for the use of the Automatic Transport Ventilator (ATV).
2. Assure that all tubing is free from kinks.
3. Determine the proper tidal volume setting (patient's weight in kilograms times 4 – 6 ml/kg)
4. Set breaths per minute (BPM) control to desired rate per minute.
5. Occlude the patient valve assembly outlet by a gloved hand. The audible pressure limit alarm should sound as the ventilator cycles through the delivery phase.
6. Assess lung compliance and chest rise with a bag-valve device. Tidal volume can be adjusted based on the patient's chest rise and physiologic response.
7. Attach the patient valve assembly to the ETT or mask on the patient.
8. Assess the ventilation.
9. Listen for bilateral lung sounds.
10. Observe for proper chest rise and fall.
11. If lung sounds are absent or only on one side only; rule out possible causes (i.e. airway obstruction, improper ETT placement, pneumothorax/tension pneumothorax).

12. Reassess the tidal volume and breaths per minute (BPM). Tidal volume can be adjusted based on the patient's chest rise and physiologic response.
13. Attach CO_2 monitoring device or colormetric chemical detection (if available).
14. Look for patient's improvement (i.e. skin color, pulse oximetry, mental status).
15. Count the number of complete ventilator cycles for a full minute.
16. Assess and manage the airway for patency.
17. If spontaneous breathing begins, it may be desirable to turn off the breaths per minute. This would allow the patient to draw oxygen up to the tidal volume limit set on the control device. If the patient is intubated and spontaneous breathing begins, contact on line medical direction for pharmacological intervention if indicated.
18. Reassess the oxygen cylinder pressure level frequently.

D. Troubleshooting

Warning: Transport of patients with the ATV requires the certified EMT-Intermediate '99 or Paramedic have a good working knowledge of the ventilator's use and problem solution. Proper emergency back up equipment or other means of positive-pressure ventilation device must be immediately available during transport.

Troubleshooting guidelines for ATV:

Indication	**Probable Cause**	**Solution**
Low pressure alarm sounds; continuous high-pitched hum	Low supply of oxygen	Always make sure an adequate supply of oxygen is available for patient use and transport
High pressure limit alarm sounds during the following indications: Decreased tidal volume or Decreased chest expansion	Leak around mask or Patient Valve tubing	Check all connections for leaks
	Inappropriate volume setting	Check Control Module setting and adjust as required
	Inappropriate Inspiratory Time setting	Check Control Module setting and adjust as required
	Decreased lung compliance and/or increased airway resistance	Evaluate patient and correct as required by adjusting Control Module settings; attempt to ventilate via other means if adjustments do not result in satisfactory ventilation of the patient
	Airway secretions	Clear airway of secretions; suction

Indication	Probable Cause	Solution
Inadequate inspiratory phase and chest movement	Blocked airway and/or a stiff lung is indicated	Increase the volume delivered to the patient, until adequate chest movement occurs, by rotating the Tidal Volume control knob in a clockwise direction. Disconnect the patient from the ventilator and attempt to ventilate via other means if adjustment do not result in adequate ventilation

IX. Decontamination and Quality Control

A. The Automatic Transport Ventilator (ATV) **must** be cleaned after every use.

Note: *Content material may vary slightly depending on the type of Automatic Transport Ventilator (ATV) being used. The instructor will need to make necessary adjustments based on the type of equipment.*

1. Control Module
   a. Leave hoses connected when decontaminating the unit.
   b. Do not submerge the control unit in liquid.
   c. Remove gross contamination by wiping with approved disinfectant solution, wipe off with clean disposable towel.
   d. Dry surface with a clean disposable towel.
   e. Discard contaminated towels into a biohazard bag.

2. Patient Valve Assembly
   a. Remove the outlet adapter and exhalation valve from the patient valve assembly.
   b. Remove gross contamination by wiping adapter and exhalation valve with an approved disinfectant solution.
   c. Dry with a clean disposable towel.
   d. Inspect each component for signs of wear (discard and replace any worn parts).
   e. Reassemble the unit.

X. Medical Direction

A. As with any EMT-I and EMT-P skill, Automatic Transport Ventilator can be performed by an EMT-I and EMT-P under the direction and in a manner consistent with A.A.C. R9-25-410, EMT Standards of Practice. A.A.C. R9-25-410 expressly requires, among other things, that an EMT-I and EMT-P comply with the treatment protocols approved by the EMT-I and EMT-P administrative medical director. Thus, an EMT-I and EMT-P may only perform Automatic Transport Ventilator with authorization from and in accordance with the medical direction of the EMT-I and EMT-P administrative medical director.

Instructor Training Resource
(OPTIONAL)

Section 1: General pathophysiology of the pulmonary system

I. Introduction
- A. Epidemiology
  - 1. Incidence
    - a. Respiratory complaints are a major aspect of EMS, resulting in 28% of all EMS chief complaints according to a US study of over 2.5 million EMS calls
  - 2. Mortality/ morbidity
    - a. Over 200,000 persons die from respiratory emergencies each year
  - 3. Risk factors
    - a. Intrinsic factors which increase the risk of developing respiratory disease
      - i. Genetic predisposition
        - (1) Influences development of
          - (a) Asthma
          - (b) COPD
          - (c) Carcinomas
      - ii. Associated cardiac or circulatory pathologies
        - (1) Influences development of
          - (a) Pulmonary edema
          - (b) Pulmonary emboli
      - iii. Stress
        - (1) Increases the severity of respiratory complaints
        - (2) May be associated with the frequency of exacerbations of asthma and COPD
    - b. Extrinsic factors which increase the risk of developing respiratory disease
      - i. Smoking
        - (1) Increases the prevalence of COPD and carcinomas
        - (2) Increases the severity of virtually all respiratory disorders
      - ii. Environmental pollutants
        - (1) Increases the prevalence of COPD
        - (2) Increases the severity of all obstructive disorders
- B. Anatomy and physiology review
  - 1. Global physiology of the pulmonary system
    - a. Function
      - i. The respiratory system functions as a gas exchange system
      - ii. 10,000 liters of air are filtered, warmed, humidified, and exchanged daily in adults
      - iii. Oxygen is diffused into the bloodstream for use in cellular metabolism by the body's 100 trillion cells
      - iv. Wastes, including carbon dioxide, are excreted from the body via the respiratory system
    - b. Physiology
      - i. Ventilation

(1) Ventilation refers to the process of air movement in and out of the lungs
(2) In order for ventilation to occur, the following functions must be intact
  (a) Neurologic control (brainstem) needs to initiate inspiration
  (b) Nerves between the brainstem and the muscles of respiration (diaphragm and intercostals) need to be intact and undamaged
  (c) Diaphragm and intercostal muscles must be functional and non-traumatized
  (d) Upper airways must be intact and patent
  (e) Lower airways must be intact and patent
  (f) The alveoli must be intact and non-collapsed
(3) Emergent intervention for ventilation problems includes
  (a) Opening the upper and lower airways
  (b) Providing assisted ventilation

ii. Diffusion
(1) Diffusion refers to the process of gas exchange between the air-filled alveoli and the pulmonary capillary bed
(2) Gas exchange is driven by simple diffusion - gases from areas of high concentration to areas of low concentration (gas exchange continues until the concentrations are equal)
(3) In order for diffusion to occur, the following functions must be intact
  (a) The alveolar walls must be intact and not thickened
  (b) The interstitial space (between the alveoli and capillary wall) must not be enlarged or filled with fluid
  (c) The capillary walls must be intact and not thickened
(4) Emergent intervention for diffusion problems includes
  (a) Provision of high flow oxygen
  (b) Taking measures to reduce inflammation in the interstitial space

iii. Perfusion
(1) Perfusion refers to the process of circulating blood through the pulmonary capillary bed
(2) In order for perfusion to occur, the following functions must be intact
  (a) There must be adequate blood volume (and adequate hemoglobin within the blood)
  (b) The pulmonary capillaries must be intact and not occluded
  (c) The left heart must be functioning properly to assure a smooth flow of blood through the pulmonary capillary bed
(3) Emergent intervention for perfusion problems includes

(a) Ensuring adequate circulating volume and hemoglobin levels
(b) Optimizing left heart function as necessary

c. Rationale behind learning physiology
i. There are many, many different pulmonary diseases
ii. Many diseases act in a variety of different ways on a number of body systems
iii. Learning the pathophysiology of every respiratory disease is impossible at the paramedic level, and is not a useful exercise because of the dynamic nature of newly developing or identified pulmonary pathologies
iv. However, all respiratory problems, old or new, can be categorized as impacting ventilation, diffusion, or perfusion
v. Treatment can be initiated rapidly and effectively once the problem has been identified as ventilation, diffusion, perfusion or a combination

2. Anatomy of the pulmonary system
a. The upper airway
i. Functions
(1) Conduit for air
(2) Filtration
(3) Warming
(4) Humidification
(5) Protection of lower airway
ii. Structures
(1) Nose
(2) Pharynx
(3) Larynx
b. The lower airway
i. Functions
(1) Conduit for air
(2) Filtration
(3) Warming
(4) Humidification
(5) Removal of foreign particles
ii. Structures
(1) Trachea
(2) Bronchi
(3) Bronchioles
(4) Cilia
c. The gas exchange interface
i. Functions
(1) Facilitate gas exchange
(2) Transfer gases
(3) Mechanism and normals
(4) Diffusion
(5) Venous partial pressures of gases
(6) Arterial partial pressures of gases
(7) Oxygen saturation
(8) Oxyhemoglobin dissociation curve

ii. Structures
(1) Alveoli
(2) Interstitial space
(3) Pulmonary capillary bed

d. The chest wall
i. Functions
(1) Ventilation
(2) Protection of lungs and airways
(3) Mechanism and normals
(4) The process of inspiration and expiration
(5) Normal respiratory volumes (total lung capacity, tidal volume)
ii. Structures
(1) Diaphragm is the major muscle of respiration
(2) Intercostal muscles
(3) Accessory muscles
(4) Pleural space

e. The neurologic control of breathing
i. Functions
(1) To control ventilation in coordination with physiologic needs
(2) Mechanism and normals
(3) Driven primarily by the pH of the cerebrospinal fluid - which is influenced by the $PaCO_2$
(4) Secondary drive is the partial pressure of CO_2 ($PaCO_2$)
(5) Tertiary drive (typically only utilized in a small number of individuals with severe pulmonary disease) is the PaO_2 as measured by peripheral baroreceptors located in the aortic arch and carotid artery
ii. Structures
(1) Medulla
(2) Phrenic nerve innervate the diaphragm
(3) Spinal nerves (thoracic levels) innervate the intercostal
(4) Hering-Breuer reflex prevents over inflation

II. General system pathophysiology, assessment and management
A. Pathophysiology
1. A variety of problems can impact the pulmonary system's ability to achieve its goal of gas exchange to provide for cellular needs and excretion of wastes
2. Understanding these problems globally can enable the paramedic to quickly and effectively pinpoint probable causes and necessary interventions
3. Specific pathophysiologies
a. Ventilation
i. Upper airway obstruction
(1) Trauma
(2) Epiglottis
(3) Foreign body obstruction
(4) Inflammation of the tonsils
ii. Lower airway obstruction
(1) Trauma

(2) Obstructive lung disease
(3) Mucous accumulation
(4) Smooth muscle spasm
(5) Airway edema

iii. Chest wall impairment
(1) Trauma
(2) Hemothorax
(3) Pneumothorax
(4) Emphysema
(5) Pleural inflammation
(6) Neuromuscular diseases (such as multiple sclerosis or muscular dystrophy)

iv. Problems in neurologic control
(1) Brainstem malfunction
(a) CNS depressant drugs
(b) CVA or other medical neurologic condition
(c) Trauma
(2) Phrenic/spinal nerve dysfunction
(a) Trauma
(b) Neuromuscular diseases

b. Diffusion
i. Inadequate oxygen concentration in ambient air
ii. Alveolar pathology
(1) Asbestosis, other environmental lung diseases
(2) Blebs/bullaes associated with chronic obstructive lung disease
(3) Inhalation injuries
iii. Interstitial space pathology
(1) Pulmonary edema
(a) High pressure (also known as cardiogenic)
(i) Left heart failure
(ii) Idiopathic pulmonary hypertension
(b) High permeability (also known as non-cardiogenic)
(i) ARDS
(ii) Asbestosis, environmental lung diseases
(iii) Near-drowning
(iv) Post-hypoxia
(v) Inhalation injuries
iv. Capillary bed pathology
(1) Severe atherosclerosis

c. Perfusion
i. Inadequate blood volume/ hemoglobin levels
(1) Hypovolemia
(2) Anemia
ii. Impaired circulatory blood flow
(1) Pulmonary embolus
iii. Capillary wall pathology
(1) Trauma

B. Assessment findings
   1. Scene size-up
      a. Pulmonary complaints may be associated with exposure to a wide variety of toxins, including carbon monoxide, toxic products of combustion, or environments which have deficient ambient oxygen (such as silos, enclosed storage spaces etc.)
      b. It is critical to assure a safe environment for all EMS personnel before initiating patient contact
      c. If necessary, individuals with specialized training and equipment should be utilized to remove the patient from a hazardous environment
   2. Initial assessment
      a. A major focus of the initial assessment is the recognition of life-threat; there are a variety of pulmonary conditions which may offer a very real risk for patient death
      b. Recognition of life threat and the initiation of resuscitation takes priority over detailed assessment
      c. Signs of life-threatening respiratory distress in adults, listed from most ominous to least severe
         i. Alterations in mental status
         ii. Severe cyanosis
         iii. Absent breath sounds
         iv. Audible stridor
         v. 1-2 word dyspnea
         vi. Tachycardia > 130 beats/minute
         vii. Pallor and diaphoresis
         viii. The presence of retractions/use of the accessory muscles
   3. Focused history and physical examination
      a. Chief complaint
         i. Dyspnea
         ii. Chest pain
         iii. Cough
            (1) Productive
            (2) Non-productive
            (3) Hemoptysis
         iv. Wheezing
         v. Signs of infection
            (1) Fever/chills
            (2) Increased sputum production
      b. History
         i. Previous experiences with similar/identical symptoms
            (1) The patient's subjective description of acuity is an accurate indicator of the acuity of this episode if the pathology is chronic
            (2) Asking the patient "what happened the last time you had an attack this bad" is an extremely useful predictor of this episode's course
         ii. Known pulmonary diagnosis
            (1) If the diagnosis is not known to the paramedic, an effort should be made to learn whether it is primarily related to ventilation, diffusion, perfusion, or a combination

iii. History of previous intubation is an accurate indicator of severe pulmonary disease, and suggests that intubation may be required again
iv. Medication history
(1) Current medications
(2) Medication allergies
(3) Pulmonary medications
(a) Sympathomimetic
(i) Inhaled
(ii) Oral
(iii) Parenteral
(b) Corticosteroid
(i) Inhaled
(ii) Oral (daily versus during exacerbations only)
(c) Chromolyn sodium
(d) Methylxanthines (theophyllin preparations)
(e) Antibiotics
(4) Cardiac-related drugs
v. History of the present episode
vi. Exposure/smoking history
c. Physical exam
i. General impression
(1) Position
(a) Sitting
(b) "Tripod" position
(c) Feet dangling
(2) Mentation
(a) Confusion is a sign of hypoxemia or hypercarbia
(b) Restlessness and irritability may be signs of fear and hypoxemia
(c) Severe lethargy or coma is a sign of hypercarbia
(3) Ability to speak
(a) 1-2 word dyspnea versus ability to speak freely
(b) Rapid, rambling speech as a sign of anxiety and fear
(4) Respiratory effort
(a) Hard work indicates obstruction
(b) Retractions
(c) Use of accessory muscles
(5) Color
(a) Pallor
(b) Diaphoresis
(c) Cyanosis
(i) Central
(ii) Peripheral
ii. Vital signs
(1) Pulse
(a) Tachycardia is a sign of hypoxemia and the use of sympathomimetic medications

(b) In the face of a pulmonary etiology, bradycardia is an ominous sign of severe hypoxemia and imminent cardiac arrest

(2) Blood pressure
- (a) Hypertension may be associated with sympathomimetic medication use

(3) Respiratory rate
- (a) The respiratory rate is not a very accurate indicator of respiratory status unless it is very slow
- (b) Trends are essential in evaluating the chronic patient
  - (i) Slowing rate in the face of an unimproved condition suggests exhaustion and impending respiratory insufficiency

(4) Respiratory patterns
- (a) Eupnea
- (b) Tachypnea
- (c) Cheyne-Stokes
- (d) Central neurogenic hyperventilation
- (e) Kussmaul
- (f) Ataxic (Biot's)
- (g) Apneustic
- (h) Apnea

iii. Head/neck
- (1) Pursed lip breathing
- (2) Use of accessory muscles
- (3) Sputum
  - (a) Increasing amounts suggests infection
  - (b) Thick, green or brown sputum suggests infection and/or pneumonia
  - (c) Yellow or pale gray sputum may be related to allergic or inflammatory etiologies
  - (d) Frank hemoptysis often accompanies severe tuberculosis or carcinomas
  - (e) Pink, frothy sputum is associated with severe, late stages of pulmonary edema
- (4) Jugular venous distention may accompany right sided heart failure, which may be caused by severe pulmonary obstruction

iv. Chest
- (1) Signs of trauma
- (2) Barrel chest demonstrates the presence of long-standing chronic obstructive lung disease
- (3) Retractions
- (4) Symmetry
- (5) Breath sounds
  - (a) Normal
    - (i) Bronchial

(ii) Bronchovesicular
(iii) Vesicular
(b) Abnormals
(i) Stridor
(ii) Wheezing
(iii) Ronchi (low wheezes)
(iv) Rales (crackles)
(v) Pleural friction rub

v. Extremities
(1) Peripheral cyanosis
(2) Clubbing is indicative of long-standing chronic hypoxemia
(3) Carpopedal spasm may be associated with hypocapnia resulting from periods of rapid, deep respiration

d. Diagnostic testing
i. Pulse oximetry
(1) Used to evaluate or confirm the adequacy of oxygen saturation
(2) May be inaccurate in the presence of conditions which abnormally bind hemoglobin, including carbon monoxide poisoning or methemoglobinemia
ii. Peak flow
(1) Provides a baseline assessment of airflow for patients with obstructive lung disease
iii. Capnometry
(1) Provides ongoing assessment of endotracheal tube position End-tidal CO_2 drops immediately when the tube is displaced from the trachea
(2) Quantitative versus qualitative

C. Management
1. Airway and ventilation
a. Head-tilt/chin-lift
b. Jaw thrust without head-tilt
c. Head-tilt/jaw thrust
d. Oropharyngeal airway
e. Nasopharyngeal airway
f. Nasal cannula
g. Simple oxygen mask
h. Nonrebreather mask
i. Pharyngeal tracheal double-lumen airway
j. Pharyngeal tracheal lumen airway
k. Bag-valve-mask
l. Bag-valve-mask with PEEP
m. CPAP
n. Orotracheal intubation
o. Nasotracheal intubation
p. Suctioning
q. Endotracheal tube
r. Oxygen powered manually triggered ventilators
s. Automatic Transport Ventilator

t. Needle cricothyroidotomy
u. Surgical cricothyroidotomy

2. Circulation
3. Pharmacological
   a. Oxygen
   b. Sympathomimetic
   c. Albuterol
   d. Epinephrine
   e. Isoetharine
   f. Metaproterenol sulfate
   g. Racemic epinephrine
   h. Terbutaline sulfate
   i. Corticosteroid
   j. Methylxanthines
   k. Theophylline ethylenediamine - aminophylline
   l. Antibiotics
   m. Mucokinetic drugs
   n. Mucolytic drugs
   o. Bronchomucotropic drugs
   p. Prophylactic asthma drugs
   q. Cough suppressants - antitussive agents
   r. "Street" drugs
4. Non-pharmacological
   a. Positioning - sitting up
   b. Back blows
5. Monitoring and devices used in pulmonary care
   a. Pulse oximetry
   b. Peak flow
   c. Capnometry
6. Transport considerations
   a. Appropriate mode
   b. Appropriate facility

Section 2: Respiratory diseases and condition

I. Specific illness
- A. Acute/adult respiratory distress syndrome
  - 1. Respiratory syndrome characterized by respiratory insufficiency and hypoxia
    - a. Triggers
      - i. Aspiration
      - ii. Cardio-pulmonary bypass surgery
      - iii. Gram-negative sepsis
      - iv. Multiple blood transfusions
      - v. Oxygen toxicity
      - vi. Trauma
      - vii. Pneumonia
      - viii. Respiratory Infection
  - 2. Findings
    - a. Shortness of breath
    - b. Rapid breathing
    - c. Inadequate oxygenation
    - d. Decreased lung compliance
  - 3. Interventions
    - a. Airway management
    - b. Oxygen administration
      - i. Mechanical ventilation
      - ii. PEEP
    - c. Improving underlying condition
    - d. Removing the cause
    - e. Suction prn

- B. Obstructive airway diseases
  - 1. A spectrum of diseases which affect a substantial number of individuals worldwide
  - 2. Diseases include asthma and COPD (which includes emphysema and chronic bronchitis)
  - 3. Epidemiology
    - a. Morbidity/mortality
      - i. Overall
      - ii. Asthma - 4-5% of US population
      - iii. 20% of adult males have chronic bronchitis
    - b. Causative factors
      - i. Cigarette smoking
      - ii. Exposure to environmental toxins
      - iii. Genetic predisposition
    - c. Factors which may exacerbate underlying conditions
      - i. Intrinsic
        - (1) Stress is a significant exacerbating factor, particularly in adults
        - (2) Upper respiratory infection
        - (3) Exercise
      - ii. Extrinsic
        - (1) Tobacco smoke

(2) Allergens (including foods, animal dander, dusts, molds, pollens)
(3) Drugs
(4) Occupational hazards

d. Prevention strategies
i. Smoking prevention, particularly for youth
ii. Stop smoking for existing smokers
iii. Control of air pollution
iv. Provision of smoke-free workplaces and public locations

4. Anatomy and physiology review
a. Ventilation disorders
b. Obstruction occurs in the bronchioles, and may be the result of
i. Smooth muscle spasm
(1) Beta receptors
ii. Mucous
(1) Goblet cells
(2) Cilia
iii. Inflammation
c. Obstruction may be reversible or irreversible
d. Obstruction causes air trapping through the following mechanism
i. Bronchioles dilate naturally on inspiration
ii. Dilation enables air to enter the alveoli despite the presence of obstruction
iii. Bronchioles naturally constrict on expiration
iv. Air becomes trapped distal to obstruction on exhalation

5. Pathophysiology varies slightly by disease
a. Asthma
i. Reversible obstruction
ii. Obstruction caused by a combination of smooth muscle spasm, mucous, and edema
iii. Exacerbating factors tend to be extrinsic in children, intrinsic in adults
iv. Status asthmaticus - prolonged exacerbation which doesn't respond to therapy
b. Chronic bronchitis
i. Reversible and irreversible obstruction
ii. Characterized by hyperplasia and hypertrophy of mucous-producing glands
iii. Clinical definition - productive cough for at least 3 months per year for 2 or more consecutive years
iv. Typically associated with cigarette smoking, but may also occur in non-smokers
c. Emphysema
i. Irreversible airway obstruction
ii. Diffusion defect also exists because of the presence of blebs
iii. Because blebs have extremely thin walls, they are prone to collapse
iv. To prevent collapse, the patient often exhales through pursed lips, effectively maintaining a positive airway pressure

v. Almost always associated with cigarette smoking or significant exposure to environmental toxins

6. Assessment findings
   a. Signs of severe respiratory impairment
      i. Altered mentation
      ii. 1-2 word dyspnea
      iii. Absent breath sounds
   b. Chief complaint
      i. Dyspnea
      ii. Cough
      iii. Nocturnal awakening with dyspnea and wheezing
   c. History
      i. Personal or family history of asthma and/or allergies
      ii. History of acute exposure to pulmonary irritant
      iii. History of prior similar episodes
   d. Physical findings
      i. Wheezing may be present in ALL types of obstructive lung disease
      ii. Retractions and/or use of accessory muscles
   e. Diagnostic testing
      i. Pulse oximeter to document degree of hypoxemia and response to therapy
      ii. Peak flow to establish baseline airflow
7. Management
   a. Airway and ventilation
      i. Intubation as required
      ii. Assisted ventilation may be necessary
      iii. High flow oxygen
   b. Circulation
      i. Intravenous therapy may be necessary to
         (1) Improve hydration
         (2) Thin and loosen mucous
      ii. Pharmacologic
         (1) Adrenergic stimulants
         (2) Albuterol
         (3) Metaproterenol
         (4) Terbutaline
         (5) Atropine sulfate
         (6) Magnesium
         (7) Methylxanthines
         (8) Corticosteroid
   c. Supportive care
   d. Transport considerations
      i. Appropriate mode
      ii. Appropriate facility
      iii. Continue monitoring
      iv. Contact medical direction
   e. Psychological support/communication strategies

C. Pneumonia
   1. Epidemiology

a. Incidence
    i. Fifth leading cause of death in the US
    ii. Not a single disease, but a group of specific infections
b. Risk factors
    i. Cigarette smoking
    ii. Alcoholism
    iii. Exposure to cold
    iv. Extremes of age (old or young)
c. Anatomy and physiology review
    i. Cilia
    ii. Causes and process of mucous production

2. Pathophysiology
    a. Ventilation disorder
    b. Infection of lung parenchyma
        i. Most commonly bacterial
        ii. May also be viral or fungal
    c. May cause alveolar collapse (atelectasis)
    d. Localized inflammation/infection may become systemic, leading to sepsis and septic shock
    e. Community acquired versus hospital acquired
3. Assessment findings
    a. Typical pneumonia
        i. Acute onset of fever and chills
        ii. Cough productive of purulent sputum
        iii. Pleuritic chest pain (in some cases)
        iv. Pulmonary consolidation on auscultation
        v. Location of bronchial breath sounds
        vi. Rales
        vii. Egophony
    b. Atypical pneumonia
        i. Non-productive cough
        ii. Extra-pulmonary symptoms
        iii. Headache
        iv. Myalagias
        v. Fatigue
        vi. Sore throat
        vii. Nausea, vomiting, diarrhea
        viii. Fever and chills
4. Management
    a. Airway and ventilation
        i. Intubation may be required
        ii. Assisted ventilation as necessary
        iii. High flow oxygen
    b. Circulation
        i. Intravenous access
        ii. Administration of IV fluids
        iii. Improve hydration
        iv. Thin and mobilize mucous
    c. Pharmacological

- i. Bronchodilators may be required if airway obstruction is severe or if the patient has accompanying obstructive lung disease
- ii. Antibiotic therapy by prescription
- iii. Antipyretics

d. Non-pharmacological
- i. Cool if high fever

e. Transport considerations
- i. Elderly, over 65 years
  - (1) Significant co-morbidity
  - (2) Inability to take oral medications
  - (3) Support complications
  - (4) Appropriate facility

f. Psychological support/ communication strategies

D. Pulmonary edema

1. Not a disease but a pathophysiological condition
   a. High pressure (cardiogenic)
   b High permeability (non-cardiogenic)
2. Epidemiology
   a. Risk factors vary based on type
      - i. High pressure (cardiogenic)
        - (1) Acute myocardial infarction
        - (2) Chronic hypertension
        - (3) Myocarditis
      - ii. High permeability (non-cardiogenic)
        - (1) Acute hypoxemia
        - (2) Near-drowning
        - (3) Post-cardiac arrest
        - (4) Post shock
        - (5) High altitude exposure
        - (6) Inhalation of pulmonary irritants
        - (7) Adult respiratory distress syndrome (ARDS)
3. Anatomy and physiology review
   a. Alveoli
   b. Pulmonary capillaries
   c. Interstitial space and fluid
   d. Pulmonary circulation
   e. Role of surfactant
   f. Hydrostatic pressure
   g. Colloid osmotic pressure
   h. Capillary wall damage
   i. Left sided heart failure
   j. Lymphatic drainage
   k. Pulmonary blood pressures
   l. Starling's law of the heart
   m. Hypoalbuminemic states (liver disease)
4. Pathophysiology
   a. Diffusion disorder
   b. High pressure (cardiogenic)
      - i. Left sided heart failure
      - ii. Increase in pulmonary venous pressure

iii. Increase in hydrostatic pressure
iv. Engorgement of pulmonary vasculature
v. Failure of cough and lymphatics to drain fluids
vi. Excessive accumulation of fluid in the interstitial space
vii. Widening interstitial space impairs diffusion
viii. In severe cases, fluid may accumulate in the alveoli

c. High permeability (non-cardiogenic)
i. Disruption of the alveolar-capillary membranes caused by
(1) Severe hypotension
(2) Severe hypoxemia (post-drowning, post-cardiac arrest, severe seizure, prolonged hypoventilation)
(3) High altitude
(4) Environmental toxins
(5) Septic shock
ii. Disrupted membranes leak fluid into the interstitial space
iii. Widened interstitial space impairs diffusion

5. Assessment findings
a. High pressure (cardiogenic)
i. Refer to cardiology unit
b. High permeability (non-cardiogenic)
i. History of associated factors
(1) Hypoxic episode
(2) Shock (hypovolemic, septic, or neurogenic)
(3) Chest trauma
(4) Recent acute inhalation of toxic gases or particles
(5) Recent ascent to high altitude without climatizing
ii. Dyspnea
iii. Orthopnea
iv. Fatigue
v. Reduced exercise capacity
vi. Pulmonary rales, particularly in severe cases
c. Diagnostic testing
i. Pulse oximetry

6. Management
a. High pressure (cardiogenic)
i. Refer to cardiology unit
b. High permeability (non-cardiogenic)
i. Airway and ventilation
ii. Intubation as necessary
(1) Assisted ventilation may be required
(2) High flow oxygen
c. Circulation
i. Avoid fluid excess
ii. Monitor IV flow rates carefully
d. Pharmacological
i. Diuretics may be considered in severe cases, but are not usually appropriate since the etiology is NOT high pressure in the pulmonary capillary bed
ii. Corticosteroid to stabilize pulmonary capillary and alveolar walls

e. Non-pharmacological
   i. Position the patient in an upright position with legs dangling
   ii. Rapid removal from any environmental toxins
   iii. Rapid descent in altitude if high altitude pulmonary edema (HAPE) is suspected
f. Transport decisions
   i. Appropriate mode
   ii. Appropriate facility
g. Psychological support/communication strategies

E. Pulmonary thromboembolism
1. Epidemiology
   a. Incidence
      i. Responsible for 50,000 deaths annually
      ii. 5% of sudden deaths
   b. Mortality/morbidity
      i. Less than 10% of pulmonary emboli result in death
   c. Risk factors
      i. Recent surgery
      ii. Pregnancy
      iii. Oral contraceptives
      iv. Infection
      v. Cancer
      vi. Sickle cell anemia
      vii. Long bone fractures
      viii. Prolonged inactivity
      ix. Bedridden patients
   d. Prevention strategies
2. Anatomy and physiology review
   a. Deep veins in lower legs
   b. Venous system
   c. Coagulation of blood
   d. Role of venous stasis
   e. Venous wall injury
   f. Venous valves
   g. Pulmonary vasculature
   h. Ventilation-perfusion mismatch
3. Pathophysiology
   a. Perfusion disorder
   b. Deep vein stasis
   c. Injury to view wall
   d. Hypercoagulability
   e. Platelet aggregation
   f. Embolism size
   g. Embolism location in the legs
   h. Embolism location in the lungs
   i. Complete loss of perfusion in some area of lungs
   j. Other causes of pulmonary circulation obstruction
      i. Air
      ii. Fat
      iii. Foreign objects

iv. Venous catheters
v. Amniotic fluid

4. Assessment findings - depend on size of the clot
   a. Evidence of significant life-threatening embolus in a proximal location
      i. Altered mentation
      ii. Severe cyanosis
      iii. Profound hypotension
      iv. Cardiac arrest
   b. Chief complaint
      i. Chest pain
      ii. Dyspnea
      iii. Cough (typically non-productive)
   c. History
      i. Sudden onset
      ii. Identification of risk factors
   d. Physical findings
      i. Normal breath sounds or, in severe cases, rales
      ii. Pleural fiction rub
      iii. Tachycardia
      iv. Clinical evidence of thrombophlebitis (found in less than 50%)
      v. Tachypnea
      vi. Hemoptysis (fairly rare)
      vii. Petechiae on upper thorax and arms
5. Management - prevention has major role in management
   a. Depends on the size of the embolism
   b. Airway and ventilation
      i. Intubation if necessary
      ii. Positive pressure ventilation if required
      iii. High flow oxygen
   c. Circulation
      i. CPR if required
      ii. IV therapy; hydration based on clinical symptoms
   d. Pharmacological
      i. Thrombolytic therapy may be appropriate if the diagnosis of pulmonary embolus is confirmed, however, this is rare - especially in the out-of-hospital setting
   e. Non-pharmacological therapy
      i. Support body systems
      ii. Most severe cases will be managed as a cardiac arrest of unknown origin
   f. Transport considerations
      i. Rapid transport
      ii. Appropriate mode
      iii. Appropriate facility
   g. Psychological support/communication strategies

F. Neoplasms of the lung
   1. Epidemiology
      a Incidence
         i. 150,000 have cancer
         ii. Typical age between 55 to 65

iii. Morbidity/mortality
(1) Most die within one year
(2) 20% local lung involvement
(3) 25% spread to lymph
(4) 55% distant metastatic cancer

b. Prevention
i. Prevent starting smoking in youth
ii. Smoking cessation in smokers
iii. Avoidance of environmental hazards, particularly asbestos
iv. Cancer screening programs

2. Anatomy and physiology review
3. Pathophysiology
a. Significant variety in the cell types, and the growth rates associated with each type
4. Assessment findings
a. Signs of severe distress
i. Altered mentation
ii. 1-2 word dyspnea
iii. Severe or uncontrollable hemoptysis
b. Chief complaints
i. Cough
ii. Hemoptysis
iii. Dyspnea
iv. Hoarseness or voice change
v. Dysphagia
c. History
i. Diagnosed history of cancer
d. Physical findings
i. Signs and symptoms vary according to location of the tumor
5. Management
a. Airway and ventilation
i. Intubation if required
ii. Assisted ventilation if necessary
iii. Oxygen - flow rate based on symptoms and pulse oximetry
iv. Supportive care
b. Circulation
i. Many patients with diagnosed lung cancer with have an indwelling catheter in place. Local protocols vary regarding whether this catheter may be used for IV infusion in the field.
ii. IV infusion may be required to improve hydration or thin/ mobilize sputum
c. Pharmacological
i. Out-of-hospital therapy for lung cancer patients is symptomatic, and may include the following
(1) Bronchodilators
(2) Corticosteroid
(3) Continuation of hospital-initiated antibiotics
d. Transport considerations
i. End stage patients may have advance directives or DNR
ii. Supportive care

e. Psychological support/communication strategies
i. If diagnosed end stage
(1) Death and dying patient
(2) Family support

G. Upper respiratory infection
1. Epidemiology
a. Incidence
i. 80 million cases in 1975
b. Morbidity/mortality
i. Rarely life threatening
ii. Often exacerbates underlying pulmonary conditions
iii. Often become significant infections in patients with suppressed immune function (such as HIV)
c. Risk factors
i. Avoidance of exposure is nearly impossible because of the prevalence of causative agents
ii. Severity increases in patients with underlying pulmonary conditions
d. Prevention strategies
i. Hand washing and covering the mouth during sneezing and coughing are essential in preventing spread
2. Anatomy and physiology review
a. Nasopharynx
b. Oropharynx
c. Paranasal sinus
d. Inner ear
e. Middle ear
f. Outer ear
g. Eustachian tubes
h. Epiglottis
i. Respiratory epithelium
j. Lymphatic system
k. Secretory antibody IgA
3. Pathophysiology
a. A variety of bacteria and virus cause URI
b. 20-30% are Group A streptococci
c. 50% of pharyngitis have no demonstrated bacterial or viral cause
d. Most are self-limiting diseases
4. Assessment findings
a. Chief complaints
i. Sore throat
ii. Fever
iii. Chills
iv. Headache
b. Physical findings
i. Cervical adenopathy
ii. Erthyematous pharynx
iii. Positive throat culture
5. Management
a. Airway and ventilation

i. Typically no intervention required
ii. Oxygen administration may be appropriate in patients with underlying pulmonary conditions (administer based on symptoms and pulse oximetry)

b. Pharmacological
i. Out-of-hospital care is symptomatic, and based in part on the presence of underlying pulmonary conditions
ii. Interventions which may be appropriate include
(1) Bronchodilators
(2) Continuation of prescribed antibiotics
(3) Corticosteroid

c. Non-pharmacological

d. Transport considerations
i. Appropriate mode
ii. Appropriate facility

e. Psychological support/communication strategies
i. Collected throat cultures require family notification of results and follow-up care

H. Spontaneous pneumothorax

1. Epidemiology
a. Incidence
i. 18 per 100,000
b. Morbidity/mortality
i. 15-20% partial pneumothorax may be well tolerated
c. Risk factors
i. Males
ii. Younger age
iii. Thin body mass
iv. History of COPD (secondary spontaneous pneumothorax)

2. Assessment findings
a. Chief complaint
i. Shortness of breath
ii. Chest pain
iii. Sudden onset
b. Physical findings
i. Typically minor
(1) Pallor
(2) Diaphoresis
(3) Tachypnea
ii. Severe
(1) Altered mentation
(2) Cyanosis
(3) Tachycardia
(4) Decreased breath sounds
(5) Local hyperresonance to percussion
(6) Subcutaneous emphysema

3. Management
a. Airway and ventilation
i. Intubation as required
ii. Assisted ventilation if necessary

- iii. Oxygen-administer levels based on symptoms and pulse oximetry
- b. Circulation
  - i. IV initiation if severe symptoms present
- c. Pharmacological
  - i. Not typically necessary; treat symptomatically
- d. Non-pharmacological
  - i. Position of comfort/best ventilation
- e. Transport considerations
  - i. Appropriate mode
  - i. Appropriate facility
- f. Psychological support/communication strategies

I. Hyperventilation syndrome

1. Multiple causes
   - a. Hypoxia
   - b. High altitude
   - c. Pulmonary disease
   - d. Pulmonary disorders
   - e. Pneumonia
   - f. Interstitial pneumonitits, fibrosis, edema
   - g. Pulmonary embolie, vascular disease
   - h. Bronchial asthma
   - i. Cardiovascular disorders
   - j. Congestive heart failure
   - k. Hypotension
   - l. Metabolic disorders
   - m. Acidosis
   - n. Hepatic failure
   - o. Neurologic disorders
   - p. Psychogenic or anxiety hypertension
   - q. Central nervous system infections, tumors
   - r. Drug-induces
   - s. Salicylate
   - t. Methylxanthine
   - u. Beta-adrenergic agonists
   - v. Progesterone
   - w. Fever, sepsis
   - x. Pain
   - y. Pregnancy
2. Assessment findings
   - a. Chief complaint
     - i. Dyspnea
     - ii. Chest pain
     - iii. Other symptoms based on etiology
     - iv. Carpopedal spasm
   - b. Physical findings
     - i. Rapid breathing with high minute volume
     - ii. Varying depending on cause of syndrome
     - iii. Carpopedal spasm

3. Pathophysiology
    a. Depends on cause of syndrome
4. Management
    a. Depends on cause of syndrome, discussed elsewhere
        i. Airway and ventilation
            (1) Oxygen-rate of administration base on symptoms and pulse oximetry
        ii. If anxiety hyperventilation is confirmed (especially based on patient's prior history) coached ventilation/rebreathing techniques might be considered
    b. Circulation
        i. Intervention rarely required
    c. Pharmacological
        i. Intervention rarely required
    d. Non-pharmacological
        i. Intervention rarely required
        ii. Patients with anxiety hyperventilation will require psychological approaches to calm them
        iii. Have them mimic your respiratory rate and volume
        iv. Do not place bag over mouth and nose
    e. Transport considerations
        i. Appropriate mode
        ii. Appropriate facility
    f. Psychological support/communication strategies
        i. Depends on cause of hyperventilation

MODULE II

I. Psychomotor Skills

A. Given the equipment to be used, the student will practice the proper technique for using an Automatic Transport Ventilator (ATV).
B. Given the equipment to be used, in a one on one situation, the instructor will guide the student to perform the skill to proficiency.
C. In a one on one situation, the instructor will create a minimum of three scenarios which meet one or more of the following criteria:
    1. There is an indication for use of the ATV.
    2. The device fails to operate properly.
    3. How to troubleshoot the ATV.
    4. The ATV is in use when the patient begins to breath spontaneously.

Note: *The student must identify each situation correctly and perform the indicated tasks appropriately.*

II. Written Evaluation

A. Administer a written evaluation completed with 80% competency.

III. Psychomotor Skills Evaluation

A. Using the attached practical skills sheet evaluation, the student will correctly use the Automatic Transport Ventilator (ATV) to ventilate a manikin with 80% competency; no failure of critical criteria.
B. When conducting the practical testing the following conditions must be maintained:
    1. The practical exam must be conducted in a testing environment. The students must understand that they are being evaluated. Corrective guidance during the evaluation is not permitted.
    2. The evaluator must not reveal the specific criteria for failure.
    3. The student will be allowed three (3) attempts to perform the practical skills evaluation with 80% competency; no failure of critical criteria.
    4. Students who fail will go through another training session and or a remediation process.

STATE OF ARIZONA ● EMERGENCY MEDICAL SERVICES AND TRAUMA SYSTEM

Proposed Skills Evaluation
Automatic Transport Ventilator

Student's Name: _____

Date: _____ Attempt#_____

Evaluator: _____

Criteria	Points Possible	Points Attained
Takes or verbalizes universal Body Substance Isolation techniques	1	
Prepare the ATV and check oxygen source/supply	2	
Obstructs patient valve assembly with gloved hand to determine high pressure alarm functioning	2	
Set the tidal volume, ventilatory rate, and alarms if available	2	
Recheck the settings as appropriate for the patient's condition	2	
Connect the ATV to the 15/22 mm fitting on the endotracheal tube	1	
Auscultate the patient's breath sounds to ensure adequate ventilation	2	
Verbalize possible complications of ATV use	2	
Reassess the oxygen supply pressure level	1	
Demonstrate trouble shooting technique	2	
Total	17	

Critical Criteria
(Failure to meet any of the critical criteria constitutes failure. The student must be remediated prior to retesting.) The student has three (3) opportunities to successfully complete the test. If a student fails to achieve a passing grade after three (3) opportunities, the student must repeat the entire course.

____ Failure to take or verbalize Body Substance Isolation precautions.
____ Failure to check oxygen supply, set the appropriate tidal volume and ventilatory rate
____ Failure to auscultate the patient's breath sound and adequate ventilation rate
____ Failure to not provide manual BVM ventilation if unable to immediately identify ventilation complications.